

PATENT APPLICATION  
Mo-6826  
LeA 34,844

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

APPLICATION OF )  
STEPHAN KIRCHMEYER ET AL ) GROUP NO.: 1711  
SERIAL NUMBER: 09/988,858 ) EXAMINER: DUC TRUONG  
FILED: NOVEMBER 21, 2001 ) RESPONSE TO PAPER NO.  
TITLE: POLYTHIOPHENES ) 061405  
)  
)  
)

**LETTER**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 2231-1450

Sir:

Enclosed is an Appeal Brief in the matter of the subject Appeal. Please charge the fee for filing the Brief, \$500.00, to our Deposit Account Number 13-3848. Triplicate copies of this paper are enclosed.

Respectfully submitted

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Date  
James R. Franks, Reg. No. 42,552  
Name of applicant, assignee or Registered Representative  
James R. Franks  
Signature  
November 30, 2005  
Date



PATENT APPLICATION  
Mo-6826  
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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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TITLE: POLYTHIOPHENES ) 061405  
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**APPEAL BRIEF**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This Brief is an appeal from the Final Office Action of the Examiner dated June 20, 2005 in which the rejections of Claims 1-11 were maintained, and added Claim 12 was finally rejected.

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enveloped addressed to: Commissioner for Patents,  
Alexandria, VA 22313-1450 11/30/05

Date

James R. Franks - Reg. No. 42,552

Name of applicant, assignee or Registered Representative

Signature

November 30, 2005

Date

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### **I. REAL PARTY IN INTEREST**

The real party in interest is Bayer MaterialScience AG.

### **II. RELATED APPEALS AND INTERFERENCES**

There are no other related appeals or interferences known to Appellants, Appellants' legal representative, or Appellants' assignee, which will directly affect or be directly affected by or have a bearing on the Board's decision in this pending appeal.

### **III. STATUS OF THE CLAIMS**

Claims Pending: 1-12

Claims Canceled: None

Claims Allowed: None

Claims Withdrawn  
from Consideration: None

Claims Appealed: 1-12

### **IV. STATUS OF AMENDMENTS**

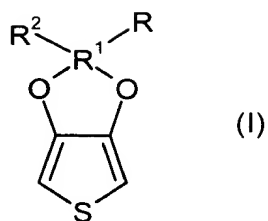
No amendment has been filed subsequent to the outstanding final rejection.

### **V. SUMMARY OF CLAIMED SUBJECT MATTER**

The present invention is directed to a process for preparing polythiophenes comprising:

(1) reacting

(a) one or more thiophenes of the general formula (I)



wherein  $R^1$  is an unsubstituted or substituted alkylene or an alkenylene radical having from 1 to 10 carbon atoms, and

$R$  and  $R^2$ , independently of one another, are hydrogen, a linear or branched alkyl radical having from 1 to 20 carbon atoms, OH, O-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-SO<sub>3</sub>H or O-alkyl having 1-18 carbon atoms,

- (b) at least one compound containing one or more sulfonic acid groups,
- (c) at least one oxidant selected from the group consisting of alkali metal peroxodisulfate, ammonium peroxodisulfate and alkali metal percarbonate,
- (d) at least one phase-transfer catalyst, and
- (e) optionally one or more catalysts, other than the at least one phase-transfer catalyst (d) with
- (f) at least one anhydrous or low-water-content solvent at a temperature ranging from 0 to about 150°C, thereby forming a product; and

(2) subsequently working up the product.

See page 3, lines 6-27, and page 6, lines 26-28 of the specification.

## **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

(I) Claims 1-12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Youngkwan Lee, *Mol. Cryst. Liq. Cryst.*, 1999, Vol. 327, pp. 237-240 (**Lee et al**).

(II) Claims 2 and 3 stand rejected under 35 U.S.C. § 102(b) as being anticipated by DE 198 41 804 A1.

(III) Claim 12 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Pielartzik et al.

## **VII. ARGUMENTS**

### **(I) CLAIMS 1-12 ARE NOT RENDERED OBVIOUS UNDER 35 U.S.C. § 103(a) OVER LEE ET AL.**

The Examiner has taken the position that, under 35 U.S.C. § 103(a), Claims 1-12 are unpatentable over Lee et al. Appellants respectfully disagree with regard to Claims 1-12.

Lee et al disclose a method of preparing poly(3,4-ethylenedioxythiophene) which involves: first dissolving ethylenedioxythiophene (EDOT) and dodecylbenzenesulfonic acid (DBSA) in a solvent (e.g., methanol); and then slowly adding an oxidant solution of ferric toluenesulfonate (FTS) to the combination of EDOT, solvent and DBSA, to conduct the polymerization. See the abstract; page 238, Experimental; and page 239, Table 1 of Lee et al.

Lee et al only disclose a method of preparing poly(3,4-ethylene-dioxythiophene) that involves the use of a transition metal oxidant (i.e., ferric toluenesulfonate). Lee et al provide no disclosure, teaching or suggestion with regard to polymerizing EDOT in the absence of a transition metal oxidant. The method of Appellants' present claims is exclusive of transition metal oxidants. The method of Appellants' claims involves the polymerization of a thiophene in the presence of an oxidant that is selected from the group consisting of alkali metal peroxodisulfate, ammonium peroxodisulfate, alkali metal percarbonate and combinations thereof.

On page 2 of the Office Action of 20 June 2005 it is argued that Lee et al's disclosure of transition metal oxidants (FeCl<sub>3</sub>, APS, and FTS) in Table 1 would somehow lead a skilled artisan to choose the non-transition metal oxidants of step-(c) of Appellants' present claims. As discussed above, the oxidants of Appellants' present step-(c) are selected from the group consisting of alkali metal peroxodisulfate, ammonium peroxodisulfate, alkali metal percarbonate and combinations thereof. The transition metal oxidants disclosed by Lee et al are not equivalent to and are structurally distinct from the oxidants of Appellants' claims. Lee et al provides no disclosure, teaching or suggestion with regard to the use of oxidants selected from alkali metal peroxodisulfate, ammonium peroxodisulfate and/or alkali metal percarbonate. In light of what Lee et al actually discloses and at the same time fails to suggest, it is respectfully submitted that the Examiner's argument is based on mere opinion. "Examiner's assumptions do not constitute the disclosure of prior art." *In re Rijckaert*, 9 F.3d 1531, 1533, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993).

Still further, Lee et al does not disclose, teach or suggest performing the polymerization of EDOT in the presence of a phase transfer catalyst. A phase transfer catalyst, like a conventional catalyst, is renewed during the course of the reaction in which it is employed, but unlike a conventional catalyst, shuttles back and forth between two different phases. Typically, a phase transfer catalyst shuttles back and forth between a phase in which a primary reaction (e.g., a polymerization reaction) is occurring (i.e., a reactive phase), and a separate phase in which the primary reaction is not occurring (i.e., a non-reactive phase). Phase transfer catalysts typically serve to remove ions from the reactive phase and deposit them in the non-reactive phase, as they shuttle back and forth between the two phases. The method of Appellants' present claims is performed in the presence of a phase transfer catalyst.

On page 2 of the Office Action of 20 June 2005, it is perplexingly argued that "in the absence of a phase transfer catalyst" the product of Lee et al would "be formed without any problems." Appellants respectfully disagree, and further submit that the Examiner's position in this regard is wholly unfounded and unsupported.

Attention is directed to the results provided by Lee et al which provide clear evidence as to the solubility and conductivity deficiencies of polythiophenes prepared by their disclosed process in water, chloroform, ACN and methanol. In particular, columns 4 and 5 of Table-1 of Lee et al show significant reductions in conductivity after filtration through a 1  $\mu$ m filter, which clearly indicates that the polythiophenes prepared by Lee et al's process contain insoluble polythiophene particles (that are retained in the filter).

Polythiophenes prepared in accordance with the method of Appellants' present claims are readily soluble in methanol and water and provide films having high conductivities. It should be further noted that polythiophenes prepared in accordance with the method of Appellants' present claims leave no residue when passed through a 0.2  $\mu$ m filter (i.e., they are substantially free of insoluble polythiophene particles). See examples 5 and 6 on pages 11-12 of Appellants' specification. In light of the preceding discussion and the results provided by Lee et al themselves, it is clear that the polythiophenes prepared by the process of Lee et al are beset with problems and undesirable deficiencies, not least of which are the concurrent formation of insoluble polythiophene particles and reduced conductivities upon filtration. As such, polythiophenes prepared by the process of Lee et al are not "formed without any problems."

"Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference." *In re Kotzab*, 217 F.3d 1365, 1370, 55 U.S.P.Q.2d 1313 (Fed. Cir. 2000).

In light of the preceding remarks, Appellants' Claims 1-12 are deemed to be unobvious and patentable over Lee et al.

(II) CLAIMS 2 AND 3 ARE NOT RENDERED ANTICIPATED, UNDER 35 U.S.C. § 102(b), BY PIELARTZIK ET AL.

The Examiner has taken the position that, under 35 U.S.C. § 102(b), Claims 2 and 3 are anticipated by Pielartzik et al. Appellants respectfully disagree with regard to Claims 2 and 3.

DE 198 41 804 A1 is discussed herein with reference to CA 2,343,444 A1, which is an English language equivalent thereof (collectively **Pielartzik et al**). A copy of CA 2,343,444 A1 was previously provided to the Office.

It is noted that Claims 2 and 3 (which here stand rejected as being anticipated) each depend separately from Claim 1, which does not stand rejected as being anticipated. As such, it is submitted that the present rejection is improper. For purposes of expediency, Appellants will argue the present rejection.

Pielartzik et al disclose a method of coating substrates (e.g., paper or plastic films) with electrically conductive structures by means of inkjet printing. A polymer solution that includes water-dispersible polyalkylene dioxythiophenes is used in the inkjet printing step. See the abstract, and page 1, lines 3-6 of Pielartzik et al.

Pielartzik et al disclose polymerizing 3,4-ethylenedioxythiophene (EDOT) in the presence of oxidants peroxydisulphate and iron(III) sulphate, and water. See Example-1, page 6, lines 10-20 of Pielartzik et al.

The method of Pielartzik et al is necessarily performed in the presence of a transition metal oxidant (i.e., iron(III) sulphate). Pielartzik et al does not disclose, teach or suggest performing their polymerization in the absence of a transition metal oxidant. The method of Appellants' present claims is exclusive of transition metal oxidants. The method of Appellants' claims involves the polymerization of a thiophene in the presence of an oxidant that is selected from the group consisting of alkali metal peroxodisulfate, ammonium peroxodisulfate, alkali metal percarbonate and combinations thereof.

The method of Pielartzik et al is necessarily performed in the presence of water. Pielartzik et al does not disclose, teach or suggest performing their polymerization in the presence of at least one anhydrous or low-water-content solvent. The method of Appellants' present claims involves the polymerization of a thiophene in the presence of an anhydrous solvent and/or a low-water-content solvent.

In addition, Pielartzik et al do not disclose, teach or suggest polymerizing EDOT in the presence of a phase transfer catalyst. As discussed previously herein, a phase transfer catalyst, like a conventional catalyst, is renewed during the course of the reaction in which it is employed, but unlike a conventional catalyst, shuttles



back and forth between two different phases. Typically, a phase transfer catalyst shuttles back and forth between a phase in which a primary reaction (e.g., a polymerization reaction) is occurring (i.e., a reactive phase), and a phase in which the primary reaction is not occurring (i.e., a non-reactive phase). Phase transfer catalysts typically serve to remove ions from the reactive phase and deposit them in the non-reactive phase, as they shuttle back and forth between the two phases.

Pielartzik et al only disclose performing the polymerization of EDOT in the presence of a transition metal oxidant. In addition, Pielartzik et al provide no disclosure, teaching or suggestion with regard to polymerizing EDOT in the presence of a phase transfer catalyst.

In light of the preceding remarks, Appellants' Claims 2 and 3 are deemed to be unanticipated by and patentable over Pielartzik et al.

(III) CLAIM 12 IS NOT RENDERED OBVIOUS UNDER 35 U.S.C. § 103(a) OVER PIELARTZIK ET AL.

The Examiner has taken the position that, under 35 U.S.C. §103(a), Claim 12 is unpatentable over Pielartzik et al. Appellants respectfully disagree with regard to Claim 12.

Pielartzik et al has been discussed previously herein and discloses a method of coating substrates (e.g., paper or plastic films) with electrically conductive structures by means of inkjet printing. A polymer solution that includes water-dispersible polyalkylene dioxythiophenes is used in the inkjet printing step. See the abstract, and page 1, lines 3-6 of Pielartzik et al.

Pielartzik et al disclose polymerizing 3,4-ethylenedioxythiophene (EDOT) in the presence of oxidants peroxydisulphate and iron(III) sulphate, and water. See Example-1, page 6, lines 10-20 of Pielartzik et al.

The method of Pielartzik et al is necessarily performed in the presence of a transition metal oxidant (i.e., iron(III) sulphate). Pielartzik et al does not disclose, teach or suggest performing their polymerization in the absence of a transition metal oxidant. The method of Appellants' present claims is exclusive of transition metal oxidants. The method of Appellants' claims involves the polymerization of a

thiophene in the presence of an oxidant that is selected from the group consisting of alkali metal peroxodisulfate, ammonium peroxodisulfate, alkali metal percarbonate and combinations thereof.

The method of Pielartzik et al is necessarily performed in the presence of water. Pielartzik et al does not disclose, teach or suggest performing their polymerization in the presence of at least one anhydrous or low-water-content solvent. The method of Appellants' present claims involves the polymerization of a thiophene in the presence of an anhydrous solvent and/or a low-water-content solvent.

In addition, Pielartzik et al do not disclose, teach or suggest polymerizing EDOT in the presence of a phase transfer catalyst. As discussed previously herein, a phase transfer catalyst, like a conventional catalyst, is renewed during the course of the reaction in which it is employed, but unlike a conventional catalyst, shuttles back and forth between two different phases. Typically, a phase transfer catalyst shuttles back and forth between a phase in which a primary reaction (e.g., a polymerization reaction) is occurring (i.e., a reactive phase), and a phase in which the primary reaction is not occurring (i.e., a non-reactive phase). Phase transfer catalysts typically serve to remove ions from the reactive phase and deposit them in the non-reactive phase, as they shuttle back and forth between the two phases.

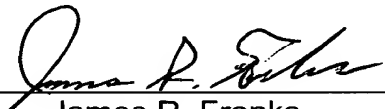
Pielartzik et al only disclose performing the polymerization of EDOT in the presence of a transition metal oxidant. In addition, Pielartzik et al provide no disclosure, teaching or suggestion with regard to polymerizing EDOT in the presence of a phase transfer catalyst.

"Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference." *In re Kotzab*, 217 F.3d at 1370.

In light of the preceding remarks, Appellants' Claim 12 is deemed to be unobvious and patentable over Pielartzik et al.

In view of the remarks herein, Appellants' respectfully submit that their claimed process is not described, taught or fairly suggested by Lee et al or Pielartzik et al. Thus, Appellants respectfully request that the Board of Appeals reverse the decision of the Examiner, and remand the application for allowance of Claims 1-12 and issuance of a patent.

Respectfully submitted,

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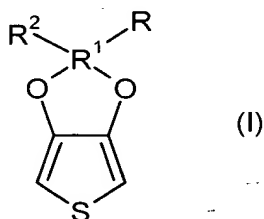
## VIII. CLAIMS APPENDIX

### CLAIMS ON APPEAL

1. (Previously Presented) A process for preparing polythiophenes comprising

(1) reacting

(a) one or more thiophenes of the general formula (I)



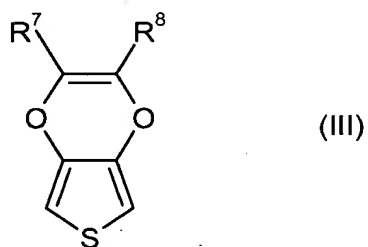
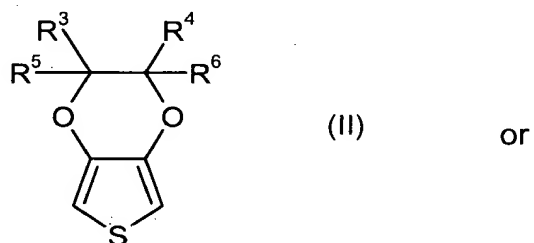
wherein  $R^1$  is an unsubstituted or substituted alkylene or an alkenylene radical having from 1 to 10 carbon atoms, and

$R$  and  $R^2$ , independently of one another, are hydrogen, a linear or branched alkyl radical having from 1 to 20 carbon atoms, OH, O-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-SO<sub>3</sub>H or O-alkyl having 1-18 carbon atoms,

- (b) at least one compound containing one or more sulfonic acid groups,
- (c) at least one oxidant selected from the group consisting of alkali metal peroxodisulfate, ammonium peroxodisulfate and alkali metal percarbonate,
- (d) at least one phase-transfer catalyst, and
- (e) optionally one or more catalysts, other than the at least one phase-transfer catalyst (d) with
- (f) at least one anhydrous or low-water-content solvent at a temperature ranging from 0 to about 150°C, thereby forming a product, and

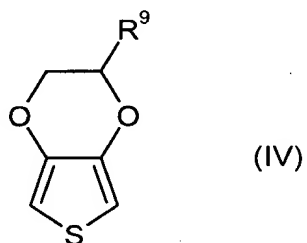
(2) subsequently working up the product.

2. (Original) The process according to Claim 1, wherein the thiophene of the formula (I) is a thiophene of the general formula (II) or (III)



wherein R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, R<sup>7</sup> and R<sup>8</sup> are hydrogen atoms, alkyl groups having from 1 to 20 carbon atoms, a hydroxymethyl groups, or alkoxymethyl groups having from 1 to 20 carbon atoms which are unsubstituted or substituted by sulfonic acid groups.

3. (Original) The process according to Claim 1, wherein the thiophene of the formula (I) is a thiophene of the formula (IV)



wherein R<sup>9</sup> is hydrogen or an alkyl radical having from 1 to 20 carbon atoms.

4. (Original) The process according to Claim 1, wherein the compound containing one or more sulfonic acid groups is at least one compound selected from the group consisting of polystyrenesulfonic acids and alkylbenzenesulfonic acids having an alkyl group containing 1–20 carbon atoms.

5. (Original) The process according to Claim 1, wherein the oxidant is at least one compound selected from the group consisting of ammonium peroxydisulfate, sodium peroxydisulfate and potassium peroxydisulfate.

6. (Original) The process according to Claim 1, wherein the phase-transfer catalyst is at least one compound selected from the group consisting of crown ethers and quaternary ammonium salts, wherein the ammonium salts have at least one hydrocarbon radical having at least 4 carbon atoms.

7. (Original) The process according to Claim 1, wherein the solvents are lower alcohols having from 1 to 8 carbon atoms.

8. (Original) The process of Claim 7, wherein the solvents are selected from the group consisting of methanol, ethanol, propanol, isopropanol, butanol and pentanol.

9. (Original) The process according to Claim 1, wherein the process is carried out by reacting:

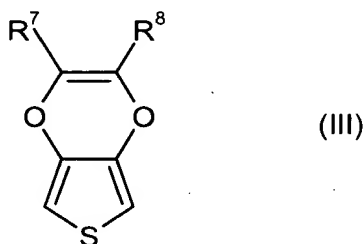
- (a) from about 0.1 to about 20 mole equivalents of sulfonic acid groups of the compound containing sulfonic acid groups, per mole of thiophenes,
- (b) from about 0.9 to about 5.0 mole equivalents of an oxidant, per mole of thiophenes,
- (c) from about 0.1 to about 10 mol% of a phase-transfer catalyst, based on the oxidant, wherein the ratio of the thiophenes and solvent is from about 0.001 to about 0.1:1,

(d) from 0 to about 10 mol% of a catalyst, other than the phase-transfer catalyst, based on thiophene, wherein the ratio of the thiophenes and solvent is from about 0.001 to about 0.1:1.

10. (Original) A polythiophene obtained with the process of Claim 1, wherein the polythiophene is a solid, a dispersion or a solution.

11. (Original) The polythiophene of Claim 10, wherein the polythiophene is a conductive coating or an anti-static coating.

12. (Previously Presented) The process of Claim 1 wherein the thiophene of formula (I) is a thiophene represented by the following general formula (III),



wherein  $R^7$  and  $R^8$  are each independently selected from the group consisting of hydrogen atoms, alkyl groups having from 1 to 20 carbon atoms, hydroxymethyl groups, alkoxymethyl groups having from 1 to 20 carbon atoms, and alkoxymethyl groups having from 1 to 20 carbon atoms which are substituted by sulfonic acid groups.

#### **IX. EVIDENCE APPENDIX**

No evidence has been submitted during the prosecution of the present case.



#### **X. RELATED PROCEEDINGS APPENDIX**

There are no other related appeals or interferences known to Appellants, Appellants' legal representative, or Appellants' assignee, which will directly affect or be directly affected by or have a bearing on the Board's decision in this pending appeal.